DETAILED ACTION

Introduction

The present office action serves as a replacement for the non-final rejection filed December 31, 2007. As such, the present action is also in response to the Request for Pre-Brief Conference filed September 6, 2007. The present action is non-final.

Response to Arguments

Applicant's arguments, filed September 6, 2007, with respect to claims 1-6, 12-17, 19, 21-25, 27, and 30 have been considered but are moot in view of the new ground(s) of rejection.

Specifically concerning supposed error number 1, examiner contends that the Tu reference, US 6,219,470, teaches in the summary of invention section, namely in column 2, lines 35-40, that the invention provides a wavelength division multiplexing transmitter and receiver. The transmitter and receiver module is the multiplexing structure for the invention. The same text continues to say that the multiplexing structure utilizes a substrate and a microstructure integral with the substrate as the building base for the multiplexing structure. However, the invention is clearly not only related to the building block for the multiplexing structure but also to the multiplexing structure itself, as explicitly seen through the words "utilizing" and "and". The disclosed structure "utilizes" the base while the combination of the structure "and" the utilized base for the structure are then clearly described in the following pages. Furthermore, the multiplexing structure is utilized both as a multiplexer and a demultiplexer, as the text clearly reveals that the base is a base for "the" multiplexer "and/or" "the" demultiplexer. The use of the

word "the" clearly points back to the same multiplexing structure, namely the transmitter and receiver module. The use of the word "and/or" shows that the structure can be used as a multiplexer, a demultiplexer, or both. Furthermore, as light is intrinsically bi-directional in nature, conceivably any multiplexer could be utilized as a demultiplexer simply by reversing the direction of light.

Specifically concerning supposed error number 2, examiner contends that the Tu reference, specifically in column 3, lines 7-9, column 3, line 40 – column 4, line 19, and column 5, lines 1-10, teaches that the structure of Figure 3, relied upon in the rejection, specifically performs a multiplexing function.

Specifically concerning supposed error number 3, examiner concedes that elements 303 and 304 of the Tu reference are not identical in nature. However, examiner has never contended that elements 303 and 304 are identical, and furthermore, they need not be in order to meet the claimed limitations. All that is required is a plurality of wavelength selecting filters, and as such, elements 303 and 304, while not needing to be identical, must both be types of wavelength selecting filters. Element 303 is clearly a wavelength selecting filter. However, element 304, disclosed as a half-mirror, appears, in examiner understanding, to be a specific type of wavelength selecting filter, as well. The function of a half mirror is to reflect some portion of propagating light while passing the remainder of the light. This is a filtering function. It appears to examiner that the filtering is based on wavelength, as column 3, line 40 – column 4, line 19, and teaches that the device acts as a multiplexer with two distinct operating wavelengths, 1.3 microns and 1.55 microns. Examiner contends that for the structure to perform a multiplexing function, the half-mirror 304 must filter based on the two operating wavelengths, passing one

wavelength and reflecting the other. Therefore, while elements 303 and 304 are not identical in structure, it appears that both elements filter light based on wavelength, and as such, the requirement for a plurality of wavelength selecting filters is met.

Specifically concerning supposed error number 4, examiner maintains that a hollow core waveguide formed in a substrate is taught by the Miura reference "Modeling and Fabrication of Hollow Optical Waveguide for Photonic Integrated Circuits," as found in pages 4785-4789 and specifically in Figures 1a and 1b. The claims, particularly due to this specific limitation, have always been presented as a combination, 103 obviousness-type rejection, and as such, it is immaterial as to whether or not the Tu reference teaches hollow core waveguides. This limitation is taught by Miura, and the combination of the hollow core waveguides formed in a substrate of Miura with the light propagating between wavelength selecting filters of Tu, renders the claimed invention obvious.

Specifically concerning supposed error number 5, examiner admits that although Tu teaches waveguide 312 formed in a substrate 301, and that light propagates between wavelength filters 303 and 304, Tu does not teach that the waveguide actually guides the light between the wavelength filters, at least not in the ordinary usage of the term "to guide". However, examiner contends that this limitation is an obvious variant, as extending the waveguide as to guide the light that already propagates between the filters would be beneficial for preventing stray scattering of light. However, this admitted deficiency in the office action directly preceding the request for pre-brief conference is grounds enough to re-open prosecution. This is also the deficiency that renders the entirety of the arguments to be considered persuasive. However, due

to the new grounds of rejection based on the obviousness of this limitation, the arguments are rendered moot.

Specifically concerning supposed error number 6, examiner maintains that a sufficient "reason" or "motivation" for combining the Tu and Miura references has been explicitly articulated, namely that the addition of the hollow core waveguides of Miura in the structure of Tu provides temperature insensitivity. Applicant has alleged that the Tu reference is already temperature insensitive, and as such, there seems to be no further motivation to combine the references. However, applicants have as yet to give any rationale for this assertion. Examiner explicitly made this same point in the response to arguments section of the final rejection mailed June 6, 2007. However, since applicant still has not provided any justification for the claim that the Tu reference already teaches temperature insensitivity, and since examiner himself has been unable to find such teaching within the Tu reference, examiner maintains that the motivation to combine the references is to provide temperature insensitivity, and that this motivation is sufficient to satisfy the requirements of the statutes.

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 1-6, 12-14, 17, 19, 22, 23, and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tu in view of Miura.

Regarding claim 1, Tu teaches an optical wavelength division multiplexer/demultiplexer device (Fig. 3) comprising a substrate (301) having a plurality of wavelength selecting filters

(303 and 304), the filters being arranged to provide conversion between a combined beam comprising a plurality of wavelength channels and a plurality of separate beams each comprising a subset of the plurality of wavelength channels (column 3, line 45 – column 4, line 3). Tu also teaches waveguides (312) formed in the substrate and that light propagates between the wavelength filters (Figure 3). Tu does not teach that the waveguides "guide" light between the wavelength filters. It would have been obvious to one of ordinary skill in the at the time of the invention to extend the waveguides of Tu such that they guide the light that already propagates between the wavelength filters. The motivation would have been to reduce stray scattering of light. Tu also does not teach that the waveguides have hollow cores. Miura teaches hollow core waveguides formed in a substrate to guide light (pages 4785-4789). It would have been obvious to one of ordinary skill in the art at the time of the invention to include the hollow core waveguides of Miura in the device of Tu. The motivation would have been increase temperature insensitivity (Miura, page 4785).

Regarding claim 2, Tu teaches that the plurality of wavelength selecting filters transmit a single wavelength channel (column 3, line 45 – column 4, line 3).

Regarding claim 3, Tu teaches that the wavelength selecting filters comprise thin film optical filters (column 3, line 45 – column 4).

Regarding claim 4, Tu teaches a plurality of alignment slots (302) arranged to receive, in alignment, the optical filters.

Regarding claim 5, Tu in view of Miura renders obvious the limitations of the base claim 4. Tu does not teach MEMS structures to provide the alignment. Miura teaches MEMS structures that provide alignment (pages 4875-4879). It would have been obvious to one of

ordinary skill in the art at the time of the invention to include the MEMS structures of Miura in the device of Tu. The motivation would have been to increase the functionality of the device (Miura, page 4875).

Regarding claim 6, Tu teaches that the substrate comprises silicon (column 3, line 45 – column 4, line 3).

Regarding claim 12, Tu in view of Miura renders obvious the limitations of the base claim 1. Tu does not teach that a base portion and a lid portion define the hollow core waveguide. Miura teaches a hollow core waveguide defined by a base portion and a lid portion (Fig. 1). It would have been obvious to one of ordinary skill in the art at the time of the invention to include the lid and base of Miura in the device of Tu. The motivation would have been to improve the confinement of light within the waveguide.

Regarding claim 13, Tu in view of Miura renders obvious the limitations of the base claim 1. Tu also teaches a further waveguide (307) provided in the substrate and that the combined beam and/or the plurality of separate beams each comprising a subset of the plurality of wavelength channels propagate to/from the plurality of wavelength selecting filters. Tu does not teach that the further waveguide "guides" the combined and/r plurality of separate beams. It would have been obvious to one of ordinary skill in the at the time of the invention to extend the further waveguide of Tu such that it guides the combined and/or plurality of separate beams that already propagate between the wavelength filters. The motivation would have been to reduce stray scattering of light. Tu also does not teach that the waveguide has a hollow core. Miura teaches hollow core waveguides formed in a substrate to guide light (pages 4785-4879). It would have been obvious to one of ordinary skill in the art at the time of the invention to include

the hollow core waveguide of Miura in the device of Tu. The motivation would have been increase temperature insensitivity (Miura, page 4785).

Regarding claim 14, Tu teaches a alignment slots (302) arranged to receive, in alignment, an optical fiber, thereby enabling light to be coupled between the optical fiber and the at least one further waveguide.

Regarding claim 17, Tu in view of Miura renders obvious the limitations of the base claim 1. Tu does not teach that the hollow core waveguide comprises a reflective element. Miura teaches a hollow core waveguide with a reflective element (Fig. 1). It would have been obvious to one of ordinary skill in the art at the time of the invention to include the reflective material of Miura in the device of Tu. The motivation would have been to improve the confinement of light within the waveguide.

Regarding claim 19, Tu in view of Miura renders obvious the limitations of the base claim 1. Tu does not teach that the hollow core waveguides are dimensioned to support fundamental mode propagation. Miura teaches fundamental mode propagation in a hollow core waveguide (pages 4786, 4787). It would have been obvious to one of ordinary skill in the art at the time of the invention to dimension the waveguides of Tu such as to support fundamental mode propagation, as taught by Miura. The motivation would have been to increase the functionality of the multiplexing capabilities.

Regarding claim 22, Tu in view of Miura renders obvious the limitations of the base claim 1. Tu does not teach that the hollow core waveguides have a substantially rectangular cross section. Miura teaches hollow core waveguides with a substantially rectangular cross section (Fig. 1). It would have been obvious to one of ordinary skill in the art at the time of the

invention to include the substantially rectangular waveguide of Miura in the device of Tu. The motivation would have been to improve alignment with the substantially rectangular device of Tu (Fig. 3).

Regarding claim 23, Tu in view of Miura renders obvious the limitations of the base claim 1. Tu does not teach at least three wavelength channels. Miura teaches a wavelength division multiplexing device comprising at least three wavelength channels (page 4786). It would have been obvious to one of ordinary skill in the art at the time of the invention to include the at least three wavelength channels of Miura in the device of Tu. The motivation would have been to increase the functionality of the multiplexing capabilities.

Regarding claim 30, Tu teaches a substrate (301) for an optical wavelength multiplexer/demultiplexer device (Fig. 3) comprising a plurality of alignment slots (302) for receiving a plurality of wavelength selecting filters (303 and 304) and waveguides (312) that provide light which propagates between the alignment slots wherein the arrangement provides, when appropriate wavelength selecting filters are located in the alignment slots, conversion between a combined beam comprising a plurality of wavelength channels and a plurality of beams comprising a single wavelength channel (column 3, line 45 – column 4, line 3). Tu does not teach that the waveguides "guide" the light that already propagates between the alignment slots. It would have been obvious to one of ordinary skill in the at the time of the invention to extend the waveguides of Tu such that they guide the light that already propagates between the alignment slots. The motivation would have been to reduce stray scattering of light. Tu also does not teach that the waveguides have hollow cores. Miura teaches hollow core waveguides formed in a substrate to guide light (pages 4785-4789). It would have been obvious to one of

ordinary skill in the art at the time of the invention to include the hollow core waveguides of Miura in the device of Tu. The motivation would have been increase temperature insensitivity (Miura, page 4785).

Claims 15 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tu in view of Miura as applied to claim 14 above, and further in view of US 6,101,210 to Bestwick et al.

Regarding claims 15 and 16, Tu in view of Miura renders obvious the limitations of the base claim 14. Tu does not teach a mode matcher. Bestwick teaches a ball lens mode matcher (column 2, lines 9-16). It would have been obvious to one of ordinary skill in the art at the time of the invention to include the ball lens mode matcher of Bestwick in the device of Tu. The motivation would have been to improve coupling between the fiber and the waveguide (Bestwick, column 2, lines 9-16).

Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tu in view of Miura as applied to claim 1 above, and further in view of US 2002/0191907 to Kinoshita et al.

Regarding claim 21, Tu in view of Miura renders obvious the limitations of the base claim 1. Tu does not teach that the hollow core waveguides are dimensioned to support multi-mode propagation. Miura teaches multimode propagation in the hollow core waveguides (page 4876). It would have been obvious to one of ordinary skill in the art at the time of the invention to dimension the waveguides of Tu so that they propagate multi-mode signals, as taught by Miura. The motivation would have been to increase the functionality of the multiplexing

capabilities. Tu also does not teach that the wavelength selecting filters are spaced apart by the re-imaging distance. Kinoshita teaches wavelength selecting filters spaced apart by the re-imaging distance (paragraphs 66 and 67). It would have been obvious to one of ordinary skill in the art at the time of the invention to space the filters of Tu by the re-imaging distance, as taught by Kinoshita. The motivation would have been to enhance proper interference between wavelength modes (Kinoshita, abstract).

Claims 24, 25, and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tu in view of Miura as applied to claim 1 above, and further in view of US 6,097,517 to Okayama.

Regarding claims 24, 25, and 27, Tu in view of Miura renders obvious the limitations of the base claim 1. Tu also teaches that the device is arranged to receive a combined beam comprising a plurality of wavelength channels and to separate the combined beam into a plurality of beams each comprising a subset of the plurality of wavelength channels, and that the device is arranged to receive a plurality of beams each comprising a subset of the plurality of wavelength channels and to combine the plurality of beams to produce a combined beam comprising a plurality of wavelength channels (column 3, line 45 – column 4, line 3). Tu does not teach that one of a plurality of beams produced by a demultiplexer stage are routed to a multiplexer stage via an optical processor. Okayama teaches beams routed to a multiplexer stage via a matrix switch processor, wherein the matrix switch receives an additional wavelength channel, and the matrix switch is arranged to route at least one additional wavelength channel to the multiplexer stage (column 4, line 58 – column 5, line 12 and column 8, lines 37-57). It would have been obvious to one of ordinary skill in the art at the time of the invention to rout the beams of Tu to a

multiplexer stage via an optical processor, as taught by Okayama. The motivation would have been to reduce the size of the device (Okayama, column 4, line 58 – column 5, line 12).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jerry Martin Blevins whose telephone number is 571-272-8581. The examiner can normally be reached on Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Frank G. Font can be reached on 571-272-2415. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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FGF/jmb